Integrated Product Team (IPT) Flight Simulator

A Companion Product to the IPT Learning Campus

User's Guide

Version 1.1

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Preface

Welcome to the IPT Flight Simulator located at the IPT Learning Campus. As you know, Integrated Product Teams (IPTs) have been extensively used in the acquisition process. Survey results and field reports indicate that the acquisition workforce believes in IPTs but needs more training. The lecture series within the IPT Learning Campus accompanying this flight simulator describes an IPT model that identifies ten key success factors and four major processes used by teams in their development of products. The purpose of this simulator is to provide a practice field on which you can run an IPT and make decisions that determine your IPT's performance as a team. You will quickly see the results of your decisions, and at no risk. You can repeat runs and try different tactics.

In order to start the flight simulator you must exit the IPT Learning Campus and click on the IPT Flight Simulator icon to run the simulator. This User's Guide outlines the use of the IPT flight simulator. It is recommended that you refer to this User's Guide while running the flight simulator. The flight simulator is based on the IPT Model described in Building II Understanding IPTs. However a brief description of the model is also included in this User's Guide for convenience. Some of this information is also included within the help screens of the control panel of the simulator.

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Introduction to the IPT Flight Simulator

Welcome to the IPT Flight Simulator located at the IPT Learning Campus. The purpose of this simulator is to provide a practice field on which you can run an IPT and make decisions that determine your IPT's performance *as a team*. You will quickly see the results of your decisions, and at no risk. You can repeat runs and try different tactics. This flight simulator *does not predict results*. It is a learning tool to help team leaders become familiar with some of the major factors that influence team performance.

The simulator uses system dynamics modeling techniques to simulate an IPT chartered to produce a weapon system in five years. System dynamics modeling began in the late 1950s with J.W. Forrester's work at Massachusetts Institute of Technology (MIT). Since then the explosion of personal computers and their processing power has made system dynamics simulation available to many users. This particular simulation uses the Powersim™ system dynamics modeling application software.

The approach used here is to model some of the major relationships among the variables presented in the IPT model in Building II of the IPT Learning Campus and repeated here for your convenience. These relationships represent cause and effect influences, and generate feedback loops and time delays. These relationships involve coupled, nonlinear differential equations to be solved by computational methods. By this technique, complex systems with multiple, nonlinear, dynamic feedback loops can be solved to observe the dynamic behavior of major variables over time. This behavior then represents reality to the extent that the inputs represent a given situation. Both hard and soft variables can be simulated.

Learning Objectives

- **Improve IPT performance**: By understanding the basic factors that create IPT performance and the processes that lead to product results, you will be able to make sense of some of the complex and dynamic situations and make better decisions for your own team. You will be able to ask the right questions about team performance and recognize relationships that improve team performance.
- **Practice and improve systems thinking**: This IPT flight simulator uses system dynamics modeling to simulate the major factors influencing an IPT. In this system many things are interconnected and most of them change with time. The flight simulator allows you to see some of the cause and effect relationships across many factors and to better understand the systems aspects of IPTs. The effects of time delays, feedback loops and leverage points in the system can be observed.
- **Discover strategies for maximizing IPT performance**: The flight simulator can be played many times using different strategies for managing IPT performance to achieve target product value, product development cost and schedule objectives. There are two modes in the simulator. In the surprise-free mode the simulator runs through the development process without injecting surprises. In the surprise mode you will experience real life acquisition program impacts as budget cuts and personnel changes require you to take action to meet your objectives. You can change your decisions periodically and see the results of these changes unfold over time. This illustrates the long-term consequences of decisions and strategies.

The IPT Task

In this flight simulator, you play the role of IPT leader. You and your team have been assigned responsibility for the development of a new combat weapon system that meets all performance

requirements with a development budget of $500 million and a project deadline from start-up to initial operating capability (IOC) of five years.

The weapon system requirements are represented by a final product value denoted by the Planned Product Value *"PPv."* The actual Product Value that your team achieves at any time during the development cycle is denoted by *"Pv."* The total Planned Cumulative Product Development Cost is denoted by *"PPc."* The actual Cumulative Product Development Cost at any time during the development cycle is denoted by *"Pc."*

The IPT Leader's Responsibility

The particular system being developed is not important when running the flight simulator. Consider it as a nominal system. The planned product value curve and the planned product development cost curve are approximations of acquisition programs.

As the team leader it is your responsibility to create an environment and make decisions that get your team to perform as well as possible. The results of your team's performance will determine how well your team achieves its objective of weapon system delivery on time, within budget and meeting the product value goal.

As the team leader you will make decisions on those factors that build team performance and influence product quality, development cost and schedule. By running the model under *different scenarios* you will get a feel for the relationships among the key success factors that influence IPT performance.

Every leader who manages a program using IPTs has two responsibilities. The first is to develop a product that fully meets performance requirements, while staying within or below budget and on schedule. The second responsibility is to develop your team members so they continue to learn and contribute as a member of IPTs developing high performing acquisition systems in the future. Both of these are used as *performance measures* by the simulator.

IPT Performance Measures

The first of two overall performance measures is called *Team Performance* and indicates how well your team is doing relative to meeting performance, schedule, and development cost of the product. A strong team performance will result in a good product, on schedule, and within (or below) cost. The simulator will indicate how well you are doing at any time by comparing the results of your team's efforts against the planned product value curve, the planned cumulative cost curve, and original schedule.

Product value is similar to earned value in that it measures the progress your team has made at a given time toward achieving the final product value. This final product value is the value that the product has when it enters the Fleet. Team actions at any time during product development will add value to the product. For example, at the end of the design stage, the final design represents some part of the final value of the product. One indicator of your team's performance is determined by comparing your actual product value against the planned product value (as a function of time) to provide feedback for decision making.

The planned cumulative product development cost curve is the second indicator of *Team Performance*. Decisions you make during the development process will affect product development cost. This indicator compares planned cumulative product cost at any time to the actual cumulative product development cost at that time.

Deviation from planned schedule is the third indicator of how well your team is doing relative to the original plan. These three indicators of effectiveness are combined into the single measure: *Team Performance*.

A second overall performance measure, *Sustainable Acquisition Excellence*, shows how well you have improved the long-term capability of the acquisition process by developing your team members. To achieve *Sustainable Acquisition Excellence*, team members need to be better able to acquire systems and to work on teams. The development experiences you have given them in *team learning*, *collaboration*, *enterprise partnering*, *empowerment*, and *innovation* prepare them for higher levels of performance. These characteristics combine to create the second performance measure: S*ustainable Acquisition Excellence*.

About the Flight Simulator

Teams are complicated systems, and acting as a team leader is a challenging job. Visiting the lecture series on Understanding IPTs on the IPT Learning Campus will help you understand the key success factors and processes that drive team success. This flight simulator will reinforce those factors and help you learn key relationships and decisions that may affect your own team.

The simulator is designed to emphasize the effect of team leader decisions on the final product value and development cost. It *does not consider* specific decisions related to any given product. The emphasis is on *developing your team* to achieve high performance, and through that performance, developing the product. This simulator should not be considered as a *game*. It is easy to *win*; simply set all controls to their best values and you will succeed in developing the product. However, you won't learn much.

The IPT simulator *is not designed to give answers to specific team situations*. It cannot duplicate your own IPT and tell you what to do. What it can do is to let you *learn about major factors that influence team performance and see how they relate to team performance through simulated runs*. By varying the control settings and watching the outcome, you will get a feel for some important relationships among team parameters.

Figure 1 shows a simplified view of the IPT model. Each key success factor on the left affects team performance in a different way. Some factors must be developed by the team through learning and experience. Others may be determined by higher authority. Still others are programs that the IPT can decide to develop and implement. Taken as a group, these factors influence how well the IPT can apply the four major processes shown in the middle of the figure. It is through these four processes that the IPT manages its program and creates product value and incurs product development costs. The final result is the product or weapon system. In summary, the ten key success factors create improved team performance through the four processes, which create the final product.

Figure 2 shows the general flow of cause and effect from the ten key success factors shown on the left to the performance measures on the right. The success factors determine how effectively IPTs can apply the four processes shown in the diagram.

As the IPT performs these processes during the development cycle, it creates product value, incurs development costs, and tries to meet the planned schedule. These are shown as outcome metrics on the diagram. One final performance measure is *Team Performance*. This is a combination of product value, product development cost, and schedule.

At the bottom of the diagram, an arrow shows the influence of enterprise partnering, team collaboration, empowerment and team learning on innovation process effectiveness and the professional growth of individual team members. These are outcome metrics indicating the IPT's contribution to *Sustainable Acquisition Excellence*. As team members become competent in these areas, they become more effective in acquiring new weapon systems in their future jobs.

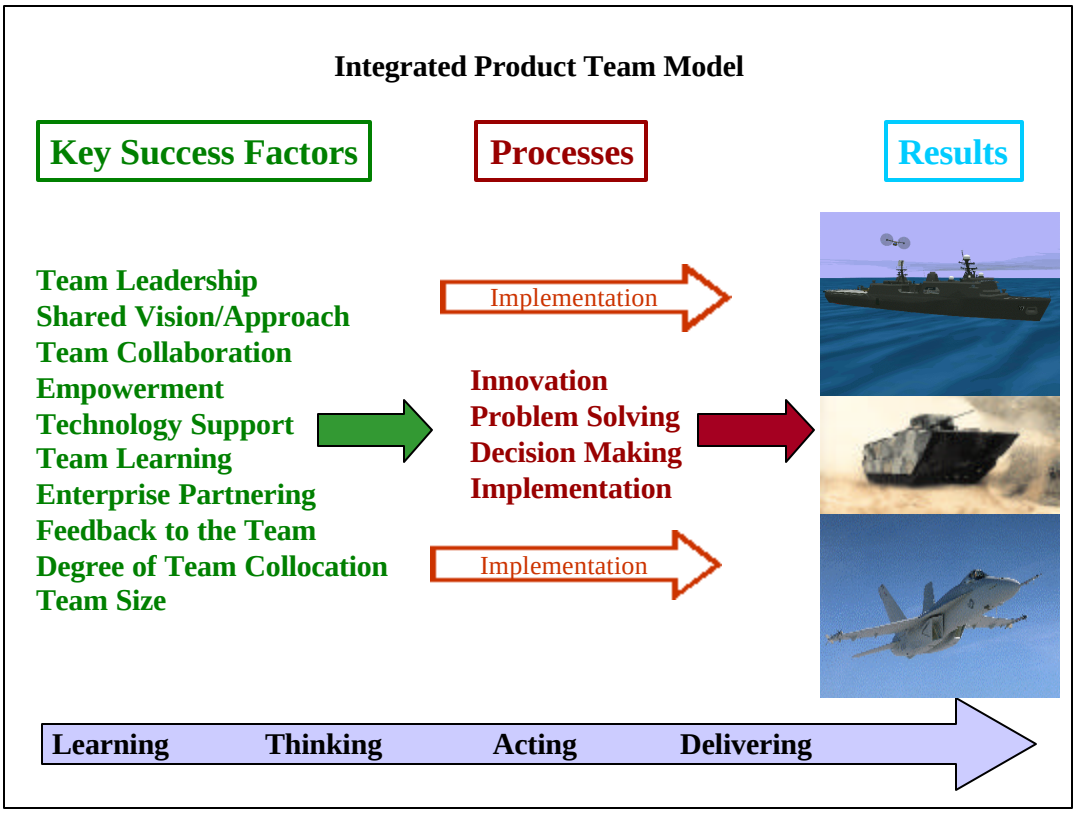

Figure 1 Simplified IPT Model

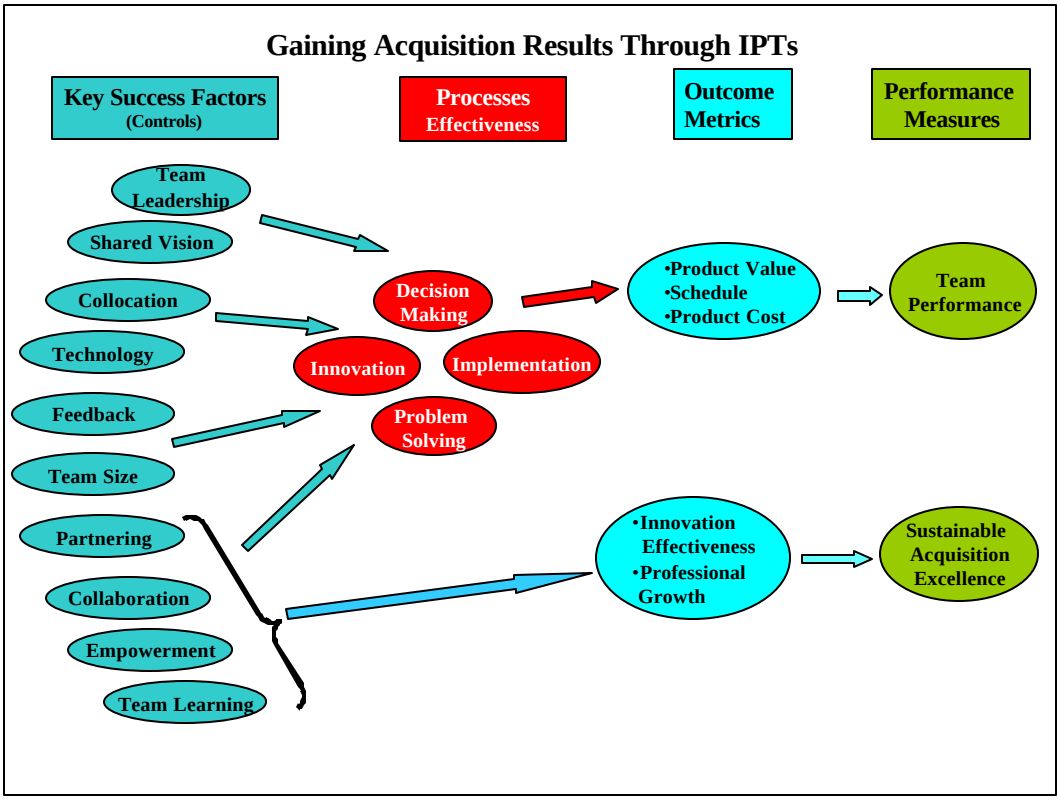

Figure 2 Simplified Causal Relationships

Combining innovation effectiveness and professional growth gives the second performance measure called *Sustainable Acquisition Excellence*. These two performance measures, *Team Performance* and *Sustainable Acquisition Excellence*, provide measures of your overall IPT's performance for each simulated run.

Figure 3 shows some of the causal loops that drive the front end of the flight simulator. The development levels of the ten key success factors on the left determine the IPT's capability to apply the four major processes depicted in the center of the figure. These capabilities then drive the actual implementation of the four processes as shown by the arrows between each process capability and its corresponding process effectiveness. At the lower left of the diagram the three success factors labeled *Team Size*, *Collocation*, and *Technology* primarily affect the efficiency of the IPT.

Notice that there are several feedback loops shown on the right side of the figure. These represent the interactions among the four processes, the product value, and the problem level. The small curve on the right is the planned product value curve. It represents the planned value of the product at any time during the development process. Product value is similar to earned value. All actions of the IPT contribute to the final value of the product. Since the product has no value at the start of the program, its value must increase during the development process from zero to the desired final value at IOC.

The problem level is determined by the difference between planned product value and actual product value at any time. If the IPT gets too far behind schedule there will be more problems, making it harder for the IPT to catch up. If the problem level increases, the IPT will have difficulty being innovative due to time constraints and pressure to meet goals.

The large "O" next to the arrow between Problem Level and Innovation Effectiveness means that as the Problem Level increases, Innovation Effectiveness will decrease. A large "S" next to an arrow means that as the element at the base of the arrow increases, the element at the tip of the arrow will also increase. For example, an IPT that gets better at problem solving (by increasing its problem solving effectiveness) will make better decisions by generating more and better alternatives available for decision selection.

The two hashed lines across the arrow between Problem Level and Problem Solving Effectiveness indicate that there will be a time delay between a change in problem level and when the IPT reacts by solving problems. Similarly there is a time delay between making and implementing a decision, or between when the team takes action to implement a decision and when the product value changes. An example would be the time between when an IPT decides to implement certain tests on a combat weapon system development and when those tests are successfully completed. The successful completion of the tests would increase the value of the weapon system.

Figure 4 shows the ten key success factors and the major causal loops among them. Each of the success factors feeds one or more of the four major process capabilities as shown in the previous figure. There is one major feedback loop that goes from team collaboration to enterprise partnering to team vision and back to team collaboration. An increase in any one of these tends to increase the others. This is not a large effect because of the large number of factors that combine to influence the process capabilities.

The "S" next to an arrow indicates that as the key success factor at the base of the arrow increases, the key success factor at the tip of the arrow will increase. In other words, both factors will go in the same direction.

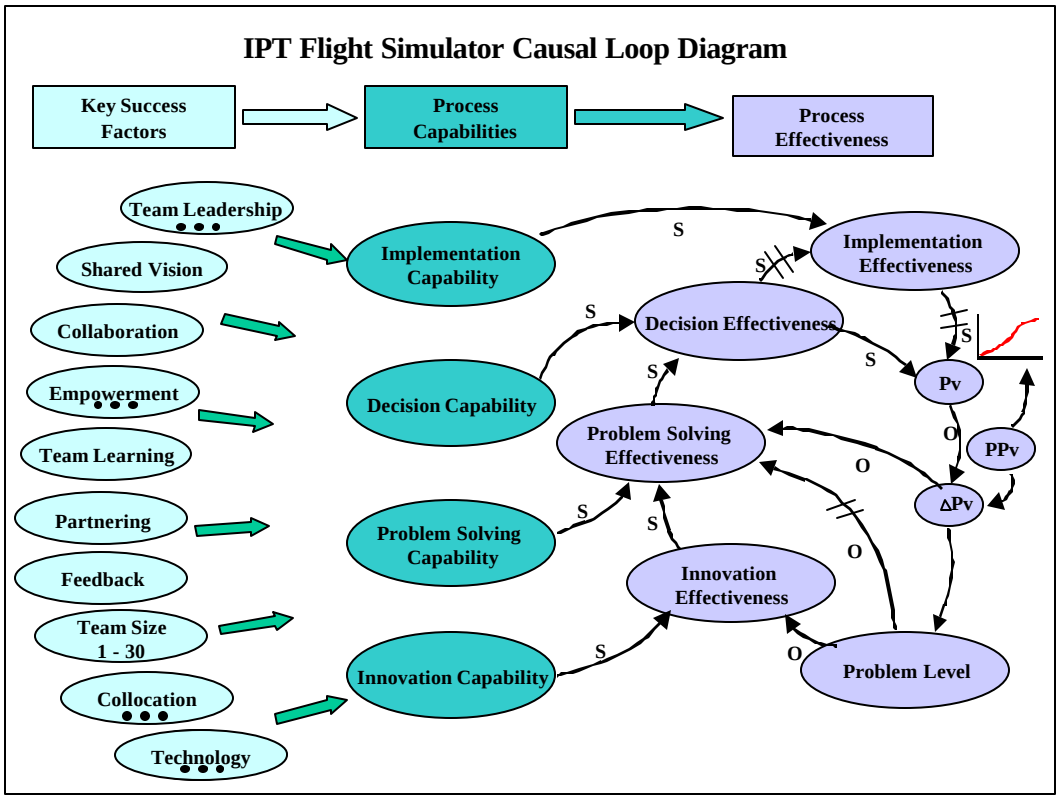

Figure 3 IPT Flight Simulator Causal Loop Diagram

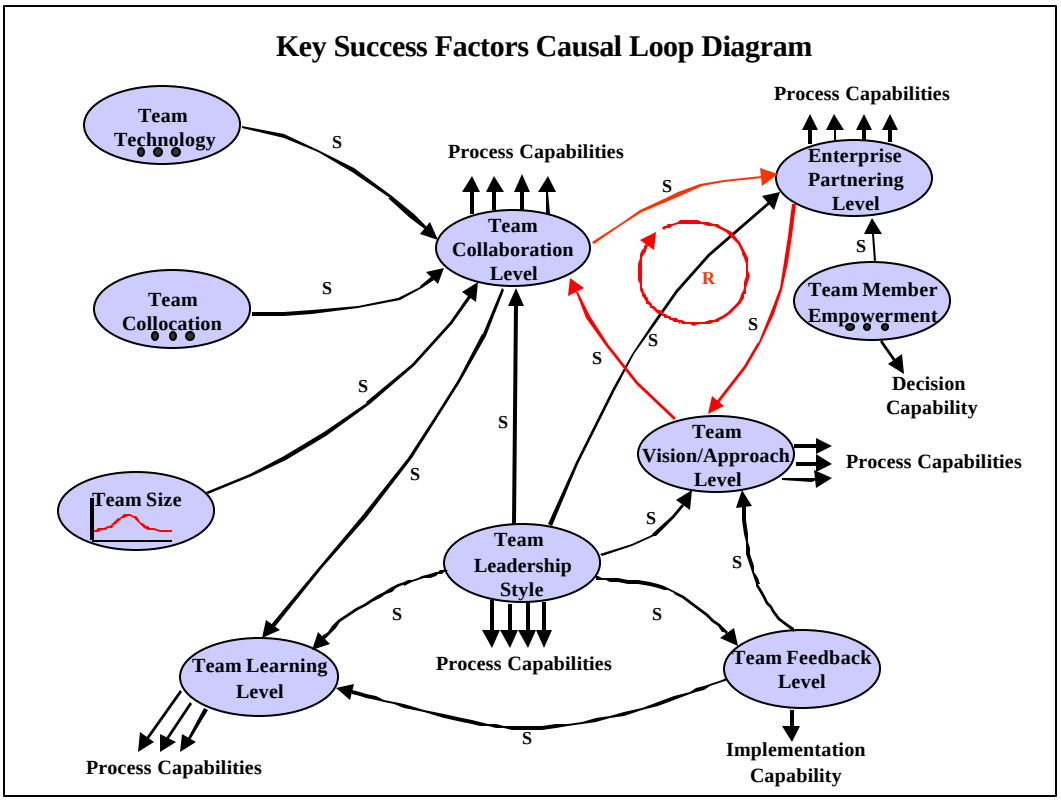

Figure 4 Key Success Factors Causal Loop Diagram

The Flight Panel (Flying the Simulator)

The flight panel has four folders: Decision, Results, Processes and Performance.

Decision Folder

Within the Decision Folder, there are twelve controls that allow you to make decisions related to team performance and to setting up the simulated run. Five depend on the amount of team development time you allocate to your team in terms of hours per six-month period. The rate of build-up of each success factor development level is shown on the box labeled *development levels*. For example, as the team learns how to collaborate, its capability improves and is shown in graphical form as the magnitude of its development level. You can increase the team development level in any of the five success factors by allocating more development time to a particular success factor. However, you are limited to no more than forty hours of development time in a six-month period. There is a time delay between when you set the development hours and when the team reaches the desired level. That delay is reduced if you make your team *proactive* rather that *reactive*.

Four of the success factors have three settings each. Team size is variable from one to thirty people. The help screen provides a brief explanation of each of the variables and windows on the flight panel.

Processes Folder

The Processes Folder shows how well your team is developing its process effectiveness in each of the four team processes: Innovation, Problem Solving, Decision Making and Implementation. These process effectiveness levels are relative levels only. Your team's ability to execute these processes directly affects how well the team can meet its planned product value, planned product development cost, and schedule commitments.

Results Folder

The Results Folder provides the real-time illustration of the product value and the product development cost. These curves tell you how well your team is doing in meeting the planned product value and planned product development cost objectives. The curves also show the affect of any decisions you make during a run. You can magnify either of the curves to get more detail. The results curve from the previous run is shown in grey. The schedule variance is shown in green at the bottom of the graphs.

Performance Folder

There are four performance indicators shown within the Performance Folder. The top two tell how your team is doing relative to deviation from planned product value and from planned product development cost. The bottom two indicators address the overall performance of the team. The first is a composite of the cost, schedule and product value variance and is the *Team Performance* measure discussed previously. The second measure shown on the bottom right indicates how well you have developed your team members' ability to improve the acquisition system in the future. This performance measure is called *Sustainable Acquisition Excellence*.

Flight Simulator Controls

1. **Team leadership**: This represents the style of the team leader.
   - **Autocratic**. The team leader is strong willed, does not listen, and makes decisions without seeking inputs.

- **Normal**. The leader sometimes makes decisions alone, although if the situation warrants, will seek advice from the team. Often the leader is participative and works with the team, letting them make decisions or provide inputs.
- **Participative**. The leader makes a few decisions alone but normally will bring the team into the process and usually allows them to make the decision. Team members are kept informed of activities and authority and responsibility are shared wherever possible.

2. **Collocation**: This is a measure of how many team members are physically located together.
   - **High.** The IPT is collocated in the same space and communication is convenient. Ideally this could include the prime contractor, the PCO, ACO, and DCMC and DCAA representatives.
   - **Medium**. Part of the IPT is in one location and the rest is in one or more locations. For example the Navy Program Office could be in Crystal City and the prime contractor team members could be located at the contractor's plant.
   - **Low**. Most of the IPT membership resides at different locations with only a few of them at the same location.
3. **Technology**: This is a measure of how much technology is used *to support the team*. This does *not* refer to the technology used in the product.
   - **High.** The team uses the latest and best technology to support its activities. Paperless office, electronic whiteboards, common databases, and voice-actuated computer programs are examples.
   - **Medium.** The team uses some technology but it is not the latest and best.
   - **Low**. The team uses the standard fax, E-mail and LANs.
4. **Empowerment**. This measures the amount of empowerment that team members have.
   - **High**. All team members are fully empowered to represent their parent organizations and to make decisions on behalf of the team.
   - **Medium**. Some team members are empowered and some are not.
   - **Low**. Only a few team members are empowered.
5. **Team Size**. This is the number of people on the team. The simulation allows team size to vary from one to thirty people. If your team has more than thirty members, set the team size to thirty. The effectiveness of the team is a function of team size. Teams that are too large, or very small, will be less effective than the optimum size of nine. The simulation assumes that the team leader will make increased use of resources outside the team if the team size is very small. Click on the RESTART button before making changes to team size for a new run.
6. **Shared Vision/Approach**. This represents the clarity and quality of the IPT's vision, and whether all team members agree with it, and will support it. It also represents agreement by the team on how it will meet its objectives.
7. **Collaboration**. The degree that team members work together with no hidden agendas and support each other and team goals. It is a major source of team synergy and effectiveness.
8. **Feedback**. A program to get feedback from customers and other key stakeholders on how well the team and its product are doing.
9. **Enterprise Partnering**. A program to establish partnering relationships with stakeholders in the enterprise to work together for the good of the IPT's product and the enterprise.

10. **Team Learning**. The ability of the IPT to learn, innovate, solve problems, make decisions, and take effective action.

NOTE: These five key success factors—*Shared Vision/Approach, Collaboration, Feedback, Enterprise Partnering,* and *Team Learning*—represent the capabilities of the IPT. The level achieved by your IPT in the simulation is determined by how much time you allow your IPT to spend developing its ability in each area. *You are allowed no more than two weeks training and development time each year*. The maximum total number of hours you can allocate to the above five key success factors is forty hours per six-month period.

11. **Management Approach**. This represents how quickly you want your IPT to respond to events, including your own control settings.
    - **Proactive**. Your IPT will take immediate action on events that happen. All time delays in the simulation are set at zero delay. This is not realistic in some situations.
    - **Normal**. Your IPT will react to events with some time delay. For example when you set any of the success factor development rates, there will be some time delay before your team improves its development level; it takes time to learn.
    - **Reactive**. Your IPT will be reactive and take a longer time responding to events.
12. **Workload.** Your IPT has a normal workload of 1,000 hours per six months. As their team leader, you may need them to work more hours at some time during the development process. If they do they will add product value at a faster rate. Realize that if they work extra hours for too long a time they will lose their efficiency and effectiveness.
    - **1,000 hours per six months**.
    - **1,100 hours per six months**.
    - **1,200 hours per six months**.
13. **Surprise.** This initiates events during a run which require you to take action to maintain the desired product value and stay within budget.
    - No Surprise. The simulation will run without any outside events occurring.
    - Surprise. Events will occur during a run which require you to take action to maintain the desired product value and total product development cost. The nature of the events is random. Click on the RUN button to resume the simulation after making your changes. Do not click on the RESTART button.
    - Repeat Surprise. The same event that happened during the last run will happen during this run.
14. **Pause Selection.** This allows you to determine how often the simulator stops during each run so you can review your team's progress and make decisions. Click on the RUN button to resume the simulation.
    - **Never**
    - **Twelve months**
    - **Six months**
15. **Run.** This starts a new simulation, or allows you to resume the simulation after the simulation pauses to allow you to make changes to your control selections.

16. **Restart.** This reinitializes the systems dynamics simulation parameters prior to starting a new run. Flight simulator controls are not changed. For a new run, click on RESTART prior to changing Team Size.
17. **Quit.** This closes the IPT Flight Simulator.

Learning Guidelines

Introduction

The purpose of this flight simulator is to improve your understanding of the key success factors that impact IPT performance. By flying the simulator you can develop an understanding and a feel for how the various factors that a team leader has to deal with interact and impact final results. This simulator has over *one billion possible combinations of settings*. Clearly we have not tried all of them! Like the real world, there are always many ways to achieve your goals. Try different combinations of settings to get your team to meet or exceed the product objectives and the *Team Performance* and *Sustainable Acquisition Excellence* measures of performance. We suggest that you read this entire section before you start. There are many hints in the following paragraphs that will make learning easier.

Familiarization

It is important to exercise the flight simulator through some of its basic runs to get a feel for how the system behaves and what the various controls and indicators represent. Try to relate cause and effect between the decisions you make by setting controls and understanding the simulation results in terms of the product value, product development cost, and schedule. Should increasing a given parameter increase or decrease the product value? Why? This may be challenging at times because of the complexity of the system and the nonlinear feedback loops.

At first try to get a feel for how the simulator and the various parameters work. Start with the minimum and the maximum settings. These will give you an indication of the range of the output variables. Note that the *optimum team size is nine people*. Also note that when the management approach control is set to *Proactive*, all decisions are executed without delay time. This setting is included so that you can see the effect of time delays on the output variables of product value and product development cost. Keep in mind that a cost reduction of only one percent is 5 million dollars in savings, or a product value improvement of one percent may make the difference in warfighting effectiveness.

System Structure

Study the structure of the IPT model by looking at the diagrams in the Model Overview folder. Note the relationships among the various parameters and see if you can recognize the general flow of cause and effect. What kind of feedback loops do you see? Notice the time delays. How do they affect decision results? For example, how long would it take for your team to develop a good vision? Or to agree on an approach to developing the product?

Suggestions

Improve your understanding and knowledge of the key success factors, select a scenario that you find interesting and do the following:

- Exercise the flight simulator and observe its behavior. Then rerun the scenario using the Pause selection button and change parameters to improve your results. See what effect the change has on the Pv and Pc curves. If you change the vision/approach development rate from zero to twenty, what happens to the vision development level curve? Is this reasonable?
- Talk to someone else and get their ideas and interpretations on what is happening.

- Think about the relationships and causal loops shown in the Model Overview folder.
- Analyze the context of the situation and interpret the simulator's behavior from several perspectives. For example how much would it cost to go from low to high technology? Or how would your enterprise react to an enterprise partnering program? Or how would you make your team more proactive?
- Think about how other stakeholders would view your decisions. For example, keeping the team size down to nine and not allowing more team members. Or insisting on full empowerment of all of your team, including those from competency or functional based organizations.
- Develop strategies for achieving different goals. For example, meeting product performance and minimizing product development cost. Or maximizing Sustainable Acquisition Excellence. Does it make any difference which key success factor you start increasing initially, or do they all have the same effect?
- Try setting all of the development rates equal to six. Set the team size to nine and working hours to 1,000. Set the other controls to their low levels and the management approach to reactive. See what the product value and product development rates are. Now change the following controls from low to high (leaving them in their high position after the change) and note the results: Management approach to proactive, then collocation to high, then technology to high, then team leadership to participative. How much does each contribute to product value and product development cost? Does this make sense? Try a different sequence. Any surprises? Remember this is a nonlinear system.

Fly the Simulator

- Change various controls and observe the results.
- Which controls affect product development cost the most? See the paragraph on system leverage points.
- What is the impact of the management approach? How important is team leadership to overall team performance?
- Why would a Participative style team leader be more effective than an Autocratic leader in a product development environment?
- In terms of team development, does it make any difference which success factor you start to develop first? Or second? Why?
- What happens when you increase the working hours to 1,100? To 1,200?
- What happens if you leave the working hours at 1,200 for more than six months? Why?
- What happens if you flip working hours every 6 months between 1,000 and 1,200 hours?
- How well can your team perform if they are allowed only one week per year of development time?

Reference Mode 1

There are many ways to achieve the planned product value and product development cost. One convenient reference is to set all five of the development rates equal to six, and the team size equal to nine. Then set the management approach to proactive, and the working hours equal to 1,000. Set team leadership equal to participative, collocation equal to maximum, empowerment equal to maximum and technology equal to maximum. This will give you 100% product value and $500 million development cost. By varying the parameters around these values you can see their effect.

Reference Mode 2

In the period 1975 to about 1990 the acquisition system was producing high quality weapon systems. Budgets were large and expanding and weapons were designed and acquired to be the best in the world. And they were. On the other hand, schedules slipped and costs overruns happened. The workforce had not heard of IPTs or IPPD and the current manpower and budget reductions had not occurred. The result was that many programs, while fully meeting performance requirements, had cost increases of ten to twenty percent and a number of them had schedule delays.

By setting the simulator controls to represent acquisitions under these conditions, you may see some interesting results. Your results will of course depend on what exact settings you think best represent the past way of doing business. Recognize that the important thing about the five key success factors of collaboration, team learning, vision/approach, enterprise partnering, and feedback is not whether the team had a formal development program but did they in fact do these things. This may be an interesting exploration in comparing then and now, but remember, there is no *right* answer.

Simulating Your Own IPT

If you are on an IPT, set the controls to represent your present situation as closely as possible. Look at the results and see what you can learn from them. One of the advantages of IPTs is that they frequently get things done in spite of difficulties. Every team works in a different environment and the specific task and situation play a big role in what is best for your team. Therefore, do not take the simulator results too seriously, whether the results appear to be too good, or too bad. Remember the simulator is not a prediction tool, it is a learning tool, and it is not right! Or wrong! It is just *one way of representing some of the important variables that a team leader must deal with*.

Note also that teams can learn and improve their performance without the formal training and development time that the simulator controls offer. Many teams do a lot to develop strong relationships with their enterprise. Whether they allocate "x" hours per six months or not is immaterial. The important thing is that they work with, rather than independent of, their surrounding stakeholders—including their contractors. When simulating your own team, make sure that you take all of the team characteristics into account.

System Delays

There are several delays in the model that represent the time it takes to get some things done. This is done to emphasize the importance of recognizing that as a team leader, things do not happen instantly and it is very important that you realize the long time needed to achieve team performance in some areas. Check the effect of these delays on the product value by changing the management approach from Reactive to Normal to Proactive. You can see how much faster the simulation responds to changes in the development settings.

System Leverage Points

The leverage points in the simulator are the time delays, the working hours, the virtuous loop, and the importance of Vision before team performance can be improved. Also important is the need for Collaboration before high performance is achievable. Cost reduction leverage is found in the effect of Feedback and Innovation. Enterprise partnering, team leadership, shared vision/approach, collaboration, and team learning drive innovation. As is to be expected, the optimum team size, use of technology, collocation, and the right kind of leadership will also significantly improve IPT performance. Some of these effects may seem small, i.e., one or two percent, or one to five million dollars. In terms of performance or cost, this is not so small.

Dealing with Surprise Behavior

Use the simulator to learn to deal with surprises. There are several real world actions that happen that will make it harder for your team to achieve product success. Dealing with these surprises will give you practice in reacting to unforeseeable events in the environment.

Strategy Development

The simulator can be used to develop strategies for success. As the environment changes, or your team characteristics change, you must make decisions that counter or take advantage of those events. The IPT flight simulator lets you develop and practice those strategies with no risk.

The IPT Model

This section provides a summary description of the conceptual model of an IPT that is detailed within the IPT Learning Campus. This model was used to design the IPT flight simulator. The flight controls of the simulator are the same as the ten elements described below that determine team capability.

The model of IPTs proposed here is designed to bring out the features of teams that have significant influence on team capability and performance. Capability refers to the capacity or ability to do something. Performance means to take effective action to meet an objective. This model is a window to view the elements that drive team performance. It is intended to help team leaders understand what makes their team effective. Combining this knowledge with the team leader's awareness of the task, the environment and individual team member capabilities, a team leader can make decisions and take actions to improve team performance.

There are ten elements that determine the capability of an IPT to do its job. These are *key success factors*. Each has an influence on how well the team can perform any of *four major processes*. These four processes change team capability into results. As an example, a high level of *team collaboration* (a key success factor) helps a team *solve problems* (a major process), which in turn leads to a better product.

Every team has some level of competency or ability in each of these elements. How they work together for a given task and in a given environment will determine the team's ability to meet its task objectives, that is, its performance goals. General considerations of the environment and the major interactions between the environment and the team provide boundary conditions within which the team must work to be effective.

In the following sections, the model is developed by taking a systems approach. The system above IPTs (its environment) is covered to understand the team's purpose and the boundary forces acting on it. The structure of teams is then developed by briefly describing the key success factors and the major processes. The last section looks at some major relationships between the success factors and the processes. Each of the ten critical success factors and four major team processes is described in more depth in the IPT Learning Campus.

Environmental Forces

Below are some general characteristics of the defense acquisition environment within which an IPT must live and produce a product. By environment is meant the aggregate of surrounding organizations, conditions or influences that affect the existence or effectiveness of the IPT and its product. Forces from the environment place demands on, and provide support to, the team and can have a strong influence on its ability to deliver products and achieve high performance.

As the Department of the Navy seeks to maintain Fleet operational capability and acquire weapon systems for the future, the acquisition environment will continue to change. Examples are shifting from

organic support to outsourcing; moving to a paperless-office; digital contracting; and an increase in government/industry partnering.

The current and anticipated acquisition budget and workforce reductions, together with continuing global threats, mean that acquisition IPTs will have less funding and fewer people, but still must develop products that fully meet Fleet needs in shorter time and at less total operating cost. This challenge will continue, and place increasing pressure on teams to perform even better than they have in the past.

Challenging objectives, a changing acquisition environment and an increasing workload put pressure on the acquisition process and create the need for high performing IPTs. These teams must have specific capabilities if they are to meet their acquisition objectives. For example, challenging objectives push for teams to find new approaches, be innovative, work smarter, cooperate to reduce waste, and maintain a clear vision.

A rapidly changing environment necessitates team flexibility and learning. Quick reaction, good feedback and dealing with uncertainty and complexity are additional traits of successful IPTs. Handling complexity means understanding and solving difficult problems and being able to make high quality decisions.

Heavy workloads mean that teams must find ways of reducing work by enterprise partnering; changing their roles, responsibilities, and relationships with stakeholders; and finding innovative and efficient ways to get work done. Acquisition cost reduction objectives press IPTs to find innovative ways to reduce costs, eliminate waste, empower team members, apply technology and continuously learn from other teams and world-class companies.

It is clear that the strong environmental forces influencing IPTs must be accounted for in the model. A measure of its usefulness is its ability to identify and explain the elements of the team that respond to those forces.

Key Success Factors

The strong environmental effects impacting IPTs place severe pressures on their ability to meet customer requirements. An important question is what are the fundamental elements that create the IPT's ability to deal effectively with these forces? In other words, what are the major causes of performance in this environment? These elements are identified as *key success factors*. They are briefly described below:

1. *Team leadership*: The ability of the team leader to lead and develop the team.
2. *Shared vision/approach*: A vision and mission that all team members accept and share. It also includes full agreement by team participants on the team's approach to carrying out its responsibilities.
3. *Team collaboration*: Team members working closely together with no hidden agendas and mutually supporting each other and team goals.
4. *Empowerment*: Team and team member capability, and authorization to represent their organization, make decisions and/or take action.
5. *Technology support*: How much and how well technology supports team needs.
6. *Team learning*: The ability of a team to continuously learn, question old assumptions, and improve its ability to take effective action.
7. *Enterprise partnering*: A program or continuous activity to establish partnering relationships with stakeholders in the enterprise.
8. *Feedback*: A program or continuous activity to get feedback from customers and other key stakeholders on how well the team and its program are doing.

9. *Team collocation*: The percentage of team members located in the same local space.
10. *Team size*: The number of full time members on the IPT.

You may have noticed that individual competency has not been identified as one of the key success factors. There is no doubt that team member competency plays a very important role in team performance. It has not been included in this model because forty years of demonstrated acquisition system performance proves that the competency of the Navy-Marine Corps acquisition workforce is high. The model therefore assumes that *all team members have the required experience and competency to perform effectively in their disciplines.*

Another success factor not used in this model is the representation of cross-functional disciplines on the IPT. It is assumed that *team members have been selected with the appropriate cross-functional disciplines*.

The last assumption is that team members have *professional attitudes toward their job and their responsibilities*. As a consequence, the proposed team model does not account for individual attitudes, behaviors, or performance problems.

Major Team Processes

While critical success factors build a team's capability, the translation of that capability into product results is through the execution of these four team processes:

1. *The innovation process*: The ability of a team to generate new ideas, processes methods, tools techniques etc.
2. *The problem solving process*: The ability of a team to identify the problem, and to generate alternatives for its solution.
3. *The decision making process*: The ability of a team to make quality decisions by selecting the best alternative.
4. *The implementation process*: The ability of a team to plan and take effective action to get the intended results.

These processes are defined such that each represents a link in the chain from the creation of an idea to the actions that produce the desired results. These major processes are indicators of the team's generic ability to generate ideas, solve problems, make decisions and take action. For example, a team can generate ideas through brainstorming, lateral thinking, or the nominal group technique. Team members working as individuals accomplish most of a team's work. The above processes are team processes and, while the team may not devote a large amount of its time to them, they play a very important role in determining team performance. Pareto's law would say that about 20% of a team's time may be spent on these processes, but they would produce 80% of the team results.

An IPT's overall competency in the four team processes is essential for high quality results. Much of *team learning* may be directed to improving its ability to use the right process at the right time. Since each of these can be accomplished in many ways, a good team has a portfolio of approaches to tackle any issue or situation.

Interrelationships

This model is designed according to the following strategy for achieving high team performance. An IPT first identifies and uses a set of *ten key success factors* to develop its ability to perform. It then uses these capabilities through the *four major processes* to achieve results. In general, there is some relationship or connection between every key success factor and every major process. In the following paragraphs the *major influence* of the success factors on each process will be described. This will

provide an understanding of how the processes depend on the success factors. Recognize, however, that every team, task and situation may call for slightly different relationships between the success factors and the processes.

Two of the key success factors will strongly affect every one of the major processes. These are *team leadership* and *team learning*. Leadership plays a role in almost everything that a team does. A good team leader exercises influence through facilitation, coaching and role modeling in all of these processes. Team learning is the development of the team's ability to execute these processes and to adapt its behavior and thinking to new challenges and tasks.

The *innovation process* is dependent upon the team's *shared vision/approach* to guide the creation of new ideas. Innovation is used to solve problems and problems are defined by some deviation between where the team wants to be and where it is. Without a vision and approach to guide them, innovation may be misguided. *Collaboration* sets the tone of team interaction, which can encourage or minimize the generation and constructive evaluation of new ideas. *Feedback* is where many new ideas come from. It is also the origin of the need for innovation and can stimulate team members to think differently about their perspectives. The three principal key success factors that affect innovation are *shared vision/approach, collaboration* and *feedback*.

Team *problem solving* is also dependent on the team's *shared vision/approach* to guide the direction of its solutions. *Collaboration*, in the same sense as above, plays a large role in team member interactions and team ability to combing divergent views and knowledge to arrive at a strong set of alternatives. Finally, *enterprise partnering* establishes relations with key stakeholders who provide different views of both problems and their possible solutions. They may also have resources or knowledge of other individuals who can help in the problem solving process. The three principal key success factors that affect problem solving are *shared vision/approach, collaboration* and *enterprise partnering.*

Team *decision making* is dependent on *collaboration* to achieve quality decisions and to get buy in from all team members. *Empowerment* is also very important because it allows team members to commit their organizations and let the team make decisions without having to get multiple agreement from enterprise stakeholders. *Team size* can affect the quality of decisions being either too small or too large. Small teams may not have enough diversity of experience and knowledge and very large teams may never reach agreement or, if they do, many team members may remain quiet and not buy into the decision. The three key success factors that affect team decision making are *collaboration, empowerment* and *team size*.

Team *implementation* is influenced by the *shared vision/approach* because it guides individuals as they carry out the plan of action and milestones. Common understanding and ownership of the team vision empowers team members to act on their own, yet stay aligned toward the team goal. *Enterprise partnering* can be of considerable value during the implementation phase of a decision. Key stakeholder support may be the difference between success and failure of a team's efforts. Often there are many organizations and individuals impacted by team decisions and any of them may have the capability to block or slow down progress if they do not support or understand what the team is doing. Empowerment supports implementation by giving team members the authority and freedom to act without continuously going back to the team for direction. The three key success factors that affect team implementation are *shared vision/approach, enterprise partnering* and *empowerment*.

In addition to affecting the major processes, the key success factors influence each other in many ways. For example, the team leader sets the tone of the team and by his/her actions and management style influences all of the other factors. A shared vision helps pull team members together and improve their collaboration level. At the same time, a high collaboration level will help a team in developing its

vision and approach to task implementation. The degree of team collocation will affect its ability to work collaboratively. Both partnering and feedback help a team develop and maintain its vision/approach.

Collaboration makes it easier for a team to learn. Enterprise partnering makes it easier for a team to obtain feedback from its stakeholders In turn, a high collaboration level can help develop and implement a strong enterprise partnering program. Feedback indicates a potential need for the team to reassess itself and can help direct team learning. Both collocation and team size can influence the degree of team collaboration.

A good use of technology improves the speed of communication and the efficiency of many of the other success factors. Thus the success factors are closely related to each other, indicating they represent the structure of a complex system. These relationships will vary in strength depending on the team, its situation and the task at hand. It is the challenge of every team to dynamically manage these factors to get the team performance needed for a given task.

This model serves as a framework for developing, leading and implementing an IPT. It acts as a reminder of the major contributors to team performance and encourages asking the right questions and making real-time decisions to maximize team performance. Each team will have to look at itself through the mirror of the model and decide what improvements are needed.

Many of the success factors and the major processes are a natural part of current IPT operations. This model is intended to bring them into the light so teams can give them serious consideration and act accordingly. All teams have a continuous choice in balancing their time between improving team competency, and meeting workload demands. If this choice is made consciously and deliberately, the team will have more control over its own actions and the result of those actions.

About the Development of the IPT Learning Campus and the IPT Flight Simulator

Dave Bennet is the subject matter expert at the IPT Learning Campus. Mr. Bennet served 20 years active duty in the Navy, with tours in the Office of Naval Research, the Navy Nuclear Power School, and Vietnam. After retirement, he was technical director and deputy program manager for two Navy ACAT I programs. He co-founded Dynamic Systems, Inc. and is currently Chairman of the Board. His research over the last 20 years has focused primarily on executive leadership, management and teamwork, including facilitation of over 50 offsites for Navy teams. As a senior member of the DoN industry-government Acquisition Reform team, Mr. Bennet led the Program Managers Assistance Group on OIPTs and WIPTs directed by ASN(RDA). For the past three years he has assisted Navy-Marine Corps IPT implementation, collecting successes and lessons learned. Mr. Bennet was supported by a senior advisory team with extensive military and civilian experience leading DoN acquisition programs.

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The IPT Flight Simulator was developed by Casey Kenaston and Dave Bennet, with assistance from John Pirone. The IPT Flight Simulator user interface was developed for the Bellwether Learning Center by Powersim™ Corporation.

